

Calculate Odds Using Outcomes or Probability

Brenda Meery
Jen Kershaw

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AUTHORS

Brenda Meery

Jen Kershaw

10.6 Calculate Odds Using Outcomes or Probability

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[Figure 1]

When you think about chances and odds, you can calculate the likelihood that an **event** will occur or not occur.

Jamie was listening to the weather forecast to determine if he and his friends should go to the beach. The weather forecaster said that there was a 4 in 5 chance of showers. What is the chance that he will be going to the beach with his friends? How can Jamie express his odds as a fraction and a percent?

In this concept, you will learn to calculate odds by using **outcomes** or **probability**.

Outcomes

The probability of an event is defined as a ratio that compares the favorable outcomes to the **total outcomes**. This ratio can be expressed in fraction form.

$$P(\text{event}) = \frac{\# \text{ of favorable outcomes}}{\text{total } \# \text{ of outcomes}}$$

Sometimes people express the likelihood of events in terms of **odds** rather than probabilities. The **odds** of an event occurring are equal to the ratio of favorable outcomes to **unfavorable outcomes**.

$$(\text{odds}) = \frac{\# \text{ of favorable outcomes}}{\text{unfavorable } \# \text{ of outcomes}}$$



[Figure 2]

Think about the odds for the arrow of the spinner above landing on red:

Favorable outcomes = 1 (red)

Unfavorable outcomes = 2 (blue, yellow)

Total outcomes = 3

So the probability of spinning red is:

$$P(\text{red}) = \frac{\# \text{ of favorable outcomes}}{\text{total } \# \text{ of outcomes}}$$

$$P(\text{red}) = \frac{1}{3}$$

While the odds in favor of red are:

$$\text{odds (in favor of red)} = \frac{\# \text{ of favorable outcomes}}{\# \text{ of unfavorable outcomes}}$$

$$\text{odds (in favor of red)} = \frac{1}{2}$$

Odds against an event occurring are defined as:

$$\text{odds (against red)} = \frac{\# \text{ of unfavorable outcomes}}{\# \text{ of favorable outcomes}}$$

$$\text{odds (against red)} = \frac{2}{1}$$

You can solve any probability problem in terms of odds rather than probabilities. Notice that the ratio represents what is being compared. Be sure that your numbers match the comparison.

You can use odds to calculate how likely an event is to happen. You can compare the odds in favor of an event with the probability that the event will actually occur.

Let's look at an example.

Suppose the weather forecast states:

- Odds in favor of rain: 7 to 3

These odds tell you not only the odds of rain, but also the odds of not raining.

If the odds in favor of rain are 7 to 3, then the odds against rain are:

- Odds against rain: 3 to 7

Another way of saying that is:

- Odds that it will NOT rain: 3 to 7

You can use this idea in many different situations. If you know the odds that something will happen, then you also know the odds that it will not happen.

Examples

Example 1

Earlier, you were given a problem about Jamie's rainy beach day.

Jamie is trying to determine if he should go to the beach with his friends and is listening to the weather forecast.

First, what is the ratio from the question?

Forecast: 4 in 5 chance of showers.

Therefore it will rain 4 times out of 5.

The chances of it not raining are 1 in 5.

Next, write the ratio of favorable to total outcomes.

$$P(\text{raining}) = \frac{\# \text{ of favorable outcomes}}{\text{total } \# \text{ of outcomes}}$$

$$P(\text{raining}) = \frac{4}{5}$$

Then express this fraction as a percent.

$$\frac{4}{5} = \frac{x}{100}$$

$$5x = 4 \times 100$$

$$5x = 400$$

$$\frac{5x}{5} = \frac{400}{5}$$

$$x = 80$$

The answer is 80.

There is an 80% chance of rain.

Example 2

What are the odds in favor of a number cube landing on 4?

First, find the favorable and unfavorable outcomes.

Favorable outcomes = 1(4)

Unfavorable outcomes = 5(1, 2, 3, 5, 6)

Next, write the ratio of favorable to unfavorable outcomes.

$$\text{odds (4)} = \frac{\# \text{ of favorable outcomes}}{\# \text{ of unfavorable outcomes}}$$

$$\text{odds (4)} = \frac{1}{5}$$

The answer is $\frac{1}{5}$.

The odds in favor of rolling a 4 are 1 to 5.

Use this spinner to calculate odds.



[Figure 3]

Example 3

Calculate the odds in favor of spinning a blue.

First, find the favorable and unfavorable outcomes.

Favorable outcomes = 1 (blue)

Unfavorable outcomes = 2 (red, yellow)

Next, write the ratio of favorable to unfavorable outcomes.

$$\begin{aligned}\text{odds (blue)} &= \frac{\# \text{ of favorable outcomes}}{\# \text{ of unfavorable outcomes}} \\ \text{odds (blue)} &= \frac{1}{2}\end{aligned}$$

The answer is $\frac{1}{2}$.

The odds in spinning a blue are 1 to 2.

Example 4

Calculate the odds in favor of spinning a red or blue.

First, find the favorable and unfavorable outcomes.

Favorable outcomes = 2 (blue or red)

Unfavorable outcomes = 1 (yellow)

Next, write the ratio of favorable to unfavorable outcomes.

$$\begin{aligned}\text{odds (blue or red)} &= \frac{\# \text{ of favorable outcomes}}{\# \text{ of unfavorable outcomes}} \\ \text{odds (blue or red)} &= \frac{2}{1}\end{aligned}$$

The answer is $\frac{2}{1}$.

The odds in spinning a blue or a red are 2 to 1.

Example 5

Calculate the odds against spinning a red or blue.

First, find the favorable and unfavorable outcomes.

Favorable outcomes = 2 (blue or red)

Unfavorable outcomes = 1 (yellow)

Next, write the ratio of favorable to unfavorable outcomes.

$$\begin{aligned}\text{odds (against red or blue)} &= \frac{\# \text{ of unfavorable outcomes}}{\# \text{ of favorable outcomes}} \\ \text{odds (against red or blue)} &= \frac{1}{2}\end{aligned}$$

The answer is $\frac{1}{2}$.

The odds against spinning a blue or a red are 1 to 2.

Review

1. For rolling a number cube, what are the odds in favor of rolling a 2?
2. For rolling a number cube, what are the odds against rolling a 2?
3. For rolling a number cube, what are the odds in favor of rolling a number greater than 3?
4. For rolling a number cube, what are the odds in favor rolling a number less than 5?
5. For rolling a number cube, what are the odds against rolling a number less than 5?
6. For rolling a number cube, what are the odds in favor of rolling an even number?
7. For rolling a number cube, what are the odds against rolling an even number?

For a spinner numbered 1–10, answer the following questions.

8. For spinning the spinner, what are the odds in favor of the arrow landing on 10?
9. For spinning the spinner, what are the odds in favor of the arrow landing on a 2 or 3?
10. For spinning the spinner, what are the odds in favor of the arrow landing on 7, 8 or 9?
11. For spinning the spinner, what are the odds in favor of NOT landing on an even number?
12. For spinning the spinner, what are the odds of the arrow NOT landing on 10?
13. For spinning the spinner, what are the odds in favor of the arrow landing on a number greater than 2?
14. For spinning the spinner, what are the odds in favor of the arrow NOT landing on a number greater than 2?
15. For spinning the spinner, what are the odds of the arrow not landing on a number greater than 3?

Review (Answers)

To see the review answers, return to the [Table of Contents](#) and select 'Other Versions' or 'Resources'.

Resources

Probability to Odds

Odds in favor of A = $\frac{P(A)}{P(\text{not } A)}$ Odds against A = $\frac{P(\text{not } A)}{P(A)}$

Find the odds in favor of rolling a 1.

$$\text{Odds} = \frac{P(1)}{P(\text{not } 1)} = \frac{\frac{1}{6} - \frac{1}{6}}{\frac{5}{6} - \frac{1}{6}} = \frac{1}{5} = 1 : 5 = 1 \text{ to } 5$$

Find the odds against rolling a 5 or 6.

$$\text{Odds} = \frac{P(\text{not } 5 \text{ or } 6)}{P(5 \text{ or } 6)} = \frac{\frac{4}{6} - \frac{1}{6}}{\frac{2}{6} - \frac{1}{6}} = \frac{4-1}{2-1} = \frac{3}{1} = 3 : 1 = 3 \text{ to } 1$$




Six Sided Die:
1, 2, 3, 4, 5, 6

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